

Organizational Roles as a Risk Factor in Coronary Heart Disease

Stephen M. Sales

Stephen M. Sales is a Study Director at the Research Center for Group Dynamics of the University of Michigan. He is also a lecturer in the Department of Psychology of that University and a Fellow of the Michigan Heart Association.

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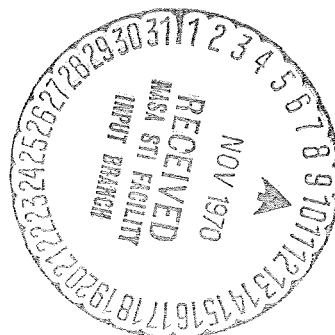
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Organizational Roles as a Risk Factor in Coronary Heart Disease¹

Recent publications in the medical journals suggest that organizational roles -- and particularly organizational roles which overload the individuals involved -- are a significant risk factor in the etiology of coronary heart disease. The present article reviews these various publications, and it summarizes data from a laboratory experiment directed toward this topic. It is concluded, both from the literature review and from the laboratory experiment, that overloading roles can be a significant risk factor in coronary disease, and that these roles exert the most deleterious influence upon individuals who are least able to cope with the role demands involved.

In recent years, the medical journals have devoted much space to investigations dealing with the relationship between organizational "stress"--broadly taken--and coronary heart disease. Although it would be incorrect to say that the various studies performed on this topic in the past decade or so are truly univocal, it nevertheless does appear that some preliminary conclusions can be drawn. However, perhaps because of the

relatively specialized readership of medical publications, these conclusions have generally not been available to organizational theorists or administrators. This is regrettable, since only these people can apply the available knowledge in ways which might reduce the risk of coronary disease faced by organizational employees.

The purpose of this article is two-fold. In the first place, we shall review here the medical investigations which are relevant to the topic of organizational influences upon coronary disease. Secondly, we shall present new data bearing on the topic at hand. These data are available elsewhere (Sales, 1969) as part of a larger investigation. However, they are repeated here because of their direct relevance to the question under study, and also because of the methodology by which they were derived. This methodology, involving the simulation of ongoing social environments in the small groups laboratory, has long been part of the social psychologist's repertory. Its application to the problem of coronary disease marks an important contribution of behavioral science to the solution of problems which are essentially medical.

Role Overload

Medical researchers have performed a variety of investigations designed to clarify the relationship between environmental "stress" (usually defined intuitively as a condition which one might expect to be noxious) and coronary disease. Unfortunately,

authors within this tradition differ greatly in the specific stressors which they use in their research. Indeed, one critic of this literature (Mirsky, 1964) has been goaded into noting that an author apparently can interpret virtually any energy transformation as a stressful event. Further, many of the specific stressors studied by medical researchers (e.g., blinking lights, exposure to severe cold) have little if any relevance to organizational phenomena. For these reasons, we shall deal here only with a single phenotypic form of organizational stress, namely "role overload." Fortunately, this happens to be a stressor which has received considerable attention in the medical literature and about which a substantial amount is known. It is also a stressor which is extremely common in organizational environments (see Kahn et al., 1964); indeed, in some organizations, role overload seems to be virtually a way of life.

By role overload, we mean a condition in which the individual is faced with a set of obligations which, taken as a set, requires him to do more than he is able in the time available. In cases under this rubric, each separate demand is within the capabilities of the focal person; however, the set of demands is beyond these capabilities, given some limitation upon the time available for performance.²

There are several implications which follow from this view of role overload. These may be briefly listed:

1. Role overload cannot be considered to be either a function of the person or a characteristic of his environment. Rather, it relates to the interaction between the person and the environment. A given set of obligations, no matter how extensive, will lead to overload only when these demands are beyond the capabilities of the person.

2. The obligations involved in role overload need not be seen as illegitimate by the focal person. The person may (and frequently will) prefer not to be asked to do all that is demanded of him; however, he need not necessarily feel that it is illegitimate that these demands be made.

3. Role overload requires that there be a time limitation on the period within which the obligations in question may be met. This is because, as noted above, each of the demands involved is within the ability of the person. Thus, if the person had an infinite amount of time available, he could always deal with any set of such demands. For this reason, role overload and deadline pressures are necessarily intimately related.

4. Role overload is one phenotypic variation of a lack of "fit" between the person and the environment. Presumably, other types of "misfits" exist, and these may have equally important consequences. However, we shall concentrate here only on this single operational form.

5. The concept of "role overload" refers to events in the objective environment of the focal person, rather than to his beliefs concerning his environment. A person could be objectively overloaded and not experience his environment as overloading, or he could be objectively "underloaded" and yet feel that he was faced with a very high work load. Presumably, the relationship between objective work load and subjective work load is positive (e.g., see Kahn et al., 1964); however, it is unlikely to be extremely high, and it may be quite low (e.g., Kraut, 1965).

Role Overload and Coronary Disease

There are two sets of investigations which point to role overload as one factor in the etiology of coronary heart disease. The first of these deals with subjects' serum cholesterol as the dependent variable; the second deals with coronary disease itself as the dependent variable. We shall consider studies from these two traditions in a single section here, since by now it is quite clear that high levels of serum cholesterol are undeniably associated with an elevated incidence of coronary heart disease (e.g., see Doyle et al., 1959; Ward and Hook, 1962; Paul et al., 1963; Cady et al., 1964; Chapman and Massey, 1964; Gertler and White, 1954, Dawber et al., 1951; and Gertler et al., 1967). We shall deal first with those studies which have investigated subjects' levels of serum

cholesterol, and then we shall review the studies which have dealt with subjects' risk of coronary disease itself.

In one of the earliest investigations to study the relationship between role overload and serum cholesterol, Friedman et al. (1957) observed changes in the cholesterol levels of tax accountants at various points in the fiscal year. During the experimental period (approximately five months), each subject was visited twice monthly by the experimenters. In the course of each visit the subject was "questioned intimately" about any job-related stress which he had experienced during the two preceding weeks; after the interview was completed, a blood sample was obtained.

Friedman et al. report that, while the serum cholesterol levels of the subjects remained fairly low during the early months of the year, a sharp increase in cholesterol occurred prior to the April 15th tax deadline. This elevation was observed for approximately six weeks; following the tax deadline, the cholesterol levels of the subjects fell to the values observed during January and February. No dietary changes which might account for these data were observed, and members of a control group (corporate accountants) evinced no such effects. If one is willing to accept income tax computation as an overloading factor in the environment of the subjects (a highly reasonable assumption), these data strongly suggest that role overload may cause increases in the serum cholesterol of

the overloaded subjects.

Other data from the same investigation support these conclusions. As one part of the study, the authors asked the subjects to judge on an intuitive basis which of the two-week periods during the course of the study was the "most stressful" and which was the "least stressful," with "stress" presumably including role overload. The cholesterol levels of each subject for these two periods were then compared. It was found that the mean cholesterol level during the stressful periods was 252 mg./100 ml., while the parallel value for the non-stressful periods was only 210 mg./100 ml. The difference was significant beyond the .001 level.

Furthermore, unknown to the authors, one of the subjects kept a weekly diary of his "experienced stress" during the course of the study. In this diary, he rated the stressfulness of each week on an arbitrary (and intuitive) scale from 1 to 100. Friedman et al., in their article, present a graph comparing these ratings with this subject's serum cholesterol levels during the experimental period; the correlation coefficient for this relationship (as computed by the present author) is .88, a highly significant (and quite impressive) figure.

From the data presented above, Friedman et al. conclude that "stress itself must be accorded primacy in the causation of the observed cholesterol changes" (Friedman et al., 1957, p. 859). In the absence of any dietary changes during the

course of the experiment, this conclusion seems to be eminently reasonable.

A series of researches performed on medical students faced with examination pressures corroborates this conclusion. In general, these studies have used a single methodology, and therefore they will be reviewed as a unit. In each, blood samples have been taken from medical students (a) at a time (or times) in which they were under no examination pressure and (b) on or near the day of an important examination. Studies which fit this paradigm include the investigations of Wertlake et al. (1958), Thomas and Murphy (1958), Grundy and Griffin (1959a), Grundy and Griffin (1959b), and Dreyfuss and Czaczkes (1959).

Each of these studies has shown an increase in serum cholesterol at the examination periods; in each case the increase was significant at the .001 level or beyond. As computed by the present author, the weighted mean for the samples drawn in the absence of examination pressure was 205 mg./100 ml., while the parallel figure for the samples drawn during the examination periods was 236 mg./100 ml. Of course, it is clear that the presence of an examination has meaning for the student other than "pure" role overload as defined herein.³ However, it is also clear that a student's work load is higher at such times than it is when no examination pressures are present, and it is certainly possible that this difference in work load contributes highly to the observed mean difference in serum cholesterol.

In other investigations, subjects' self-report (subjective) data on role overload have been correlated with their serum cholesterol levels. A representative study is that of Mueller (1965). In part of this survey, subjects (professors and administrators at the University of Michigan) were asked to respond to a six-item scale measuring the degree of quantitative role overload which they experienced in their work. The subjects' responses to this instrument correlated .25 with the amount of cholesterol in their serum. This value, with an N of 104, is significant beyond the .01 level.

Other data of interest are reported in a recent and as yet unpublished manuscript by Caplan and French (1968). In this study, Caplan and French investigated the effects of role overload and "subjective role overload" in twenty-two male white-collar employees of the National Aeronautics and Space Administration (NASA). Each of the subjects was studied on three separate occasions, with each observation period lasting between two and three hours. During each period, the subject was observed by a two-man team who recorded information on overload in the subject's work environment and monitored his heart rate. Following each observation period, a blood sample was taken. In addition, following the third observation period, the subject filled in a short questionnaire on job overload. This questionnaire served as the measure of subjective role overload.

In this study, objective role overload and subjective role overload were found to be highly related ($r = .64$). However, they were also found to have somewhat different effects upon the subjects involved. Subjective overload related strongly to heart rate ($r = .68$), and this relationship remained even when the effects of objective role overload were removed via partial correlational techniques. In contrast, objective overload was found to have no particular relationship to heart rate when the effects of subjective overload were similarly removed. Both subjective overload and objective overload, however, were positively related to serum cholesterol, and these relationships appeared to be somewhat independent of each other. Caplan and French, reviewing these data, conclude that, "Heart rate is primarily determined by the way a person perceives the environment and only indirectly by the objective overload ... (while) both objective and subjective overload seem to independently influence cholesterol" (p. 13). This study, while corroborating previously-cited findings on the relationship between overload and cholesterol levels, and while presenting new data on the relationship between overload and heart rate, also strongly suggests that every investigation on role overload should obtain independent measures of objective and subjective overload. This, to the knowledge of the present author, has been done in no study other than that of Caplan and French; however, there is no reason why it should not be done as a matter of course in future studies.

Several studies have documented a relationship between role overload and coronary heart disease itself. Russek has reported two separate investigations which are relevant to this point. In the first of these (Russek, 1962), he asked various "experts" (practicing professionals) to rank several categories of practice within the fields of medicine, dentistry, and law in terms of the "occupational stress" (including overload) which impinged upon members of these categories. Following the gathering of these ratings, Russek sent health questionnaires to a large number of persons in the three fields in question. It was found that, regardless of the specific profession involved, individuals in "high stress" categories reported a higher incidence of coronary heart disease than did individuals in medium or low stress categories. The methodology employed in this study is not totally satisfactory, since many heart attacks are "silent" (in that the victim of the attack is not aware of its occurrence) and since a variety of response biases might influence the subjects' responses to questionnaires of the sort used by Russek. Furthermore, it is clear that in this investigation overload is severely confounded with a variety of other factors. Nevertheless, it is likely that the effects of these biases would be conservative, and therefore Russek's conclusions seem warranted.

In a second study (Russek, 1965), Russek compared 100 young coronary patients with an equal number of controls. Russek reports that:

Prolonged emotional strain associated with job responsibility ... preceded the attack in 91% of the patients as compared with an occurrence of similar strain in only 20% of the normal control subjects.

(Russek, 1965, p. 189).

Furthermore, this patient-control difference in "strain associated with job responsibility" was greater than other differences between the two groups in heredity factors, high-fat diets, obesity, smoking, or lack of exercise. Virtually identical data have been reported by Weiss et al. (1957) and by Pearson and Joseph (1963).

Corroboration for this relationship is reported in part of an extensive investigation performed by Miles et al. (1954). In this study, a lengthy questionnaire and interview schedule were administered to forty-six coronary patients and forty-nine controls. Among the differences which appeared between the two groups, it was found that 50% of the patients as compared to 12% of the controls reported that "they had worked long hours with few vacations under considerable stress and strain" prior to onset of the disease. This difference between the patients and the controls is significant beyond the .01 level. The study of Miles et al. is frequently cited in the medical literature as having demonstrated that there are only minor differences in personality and social factors between coronary heart disease patients and individuals free of this disease, and indeed most of the tests performed by Miles and his coauthors did show only small differences between the two groups. However, the tendency

of the patients to be more overworked than the controls is a strong one, and it is quite congruent with the analysis presented here.

Personality and Coronary Disease

In addition to the investigations cited above, which examine direct links between role overload and coronary heart disease (or its biochemical associate, high levels of serum cholesterol), there are a variety of studies which can be interpreted as studying indirect links between role overload and coronary heart disease. These investigations have concentrated upon the relationships which obtain between various personality traits of the subjects studied and their levels of serum cholesterol (or coronary disease). These studies are directly relevant to the present concerns because some of the personality traits employed in these studies are traits which would lead individuals to place themselves in positions in which they will experience role overload.⁴ As above, we shall review first those investigations which have dealt with serum cholesterol, and then we shall turn to studies involving coronary disease itself.

Perhaps the most impressive set of researches in this area is that which has been performed by Meyer Friedman, Ray Rosenman, and their associates over the past ten years. Because of the importance of these studies, they will be dealt with at some length here.

Friedman and Rosenman have been consistently interested in a specific "behavior pattern," which they label "Type A." According to their description, the characteristics of the Type A person are as follows:

Type A ... is characterized primarily by excessive drive, aggressiveness, ambition, involvement in competitive activities, frequent vocational deadlines, pressure for vocational productivity, (and) an enhanced sense of time urgency The converse ... pattern, called Type B, is characterized by the relative absence of this interplay of psychological traits and situational pressures. The Type B subject is more relaxed and more easy going, seldom becomes impatient and takes more time to enjoy avocational pursuits. He is not easily irritated and works steadily, but without a feeling of being driven by a lack of time. He is not pre-occupied with social achievement, and is less competitive in his occupational and avocational pursuits.

(Jenkins et al., 1967, p. 371).

As may be seen from the description, the Type A person is clearly one who would be likely to overload himself. He is pictured as excessively competitive and highly oriented toward achievement, which implies that he would work both long and hard on tasks which offer achievement incentives. He is said to live habitually under time pressures, which suggests that the deadlines out of which role overload is created (see p. 3, above) consistently impinge upon him. He is seen as being ambitious, driven, and aggressive, which implies that he might accept increasingly difficult tasks in an attempt constantly to improve his social position. These habits, taken together, would suggest that overload might be a persistent, highly pervasive, and perhaps sought after factor in the life of a Type A individual.

There are at least some objective data which support the contention that the Type A person would experience more overload in life than would his opposite (the "Type B" individual). For instance, Friedman and Rosenman (1959) found that individuals judged to be "Type A" reported that they worked an average of fifty-one hours per week, while individuals judged to be "Type B" reported that they worked an average of only forty-five hours per week. Furthermore, Friedman et al. (1960) found that Type A individuals were more likely than Type B individuals to report that they felt a "moderate to severe sense of urgency of doing their job" (p. 762). None of these data, of course, is conclusive; however, the data all support the hypothesis that the Type A person is more likely to experience overload in various facets of his life than is the Type B person.

Other data, although not explicitly aimed at the personality dimension studied by Friedman, Rosenman, and their coauthors, also strongly suggest that the Type A person will experience more overload in life situations than will the Type B person. Supportive evidence on this point may be drawn from an investigation performed by Kahn et al. (1964). These authors administered a lengthy interview schedule to 53 employed men in a variety of organizational settings. This interview did not deal specifically with either role overload or the personality syndrome under question. Nevertheless, the schedule did contain three items which appeared to deal with each of these areas (e.g., "I always follow the rule: business before

pleasure" for the Type A behavior syndrome and "How frequently do you feel bothered by feeling that you have too heavy a work load, one that you can't possibly finish during an ordinary day" for role overload). As determined by the present author, these items provided reasonable scales of role overload and the Type A personality; the correlation between these two indices was $r = .46$, $p < .001$. These data support the contention that Type A individuals experience more overload than do Type B individuals in the course of their organizational activities.

The physiological differences which obtain between the Type A and the Type B subjects studied by Friedman, Rosenman, and their colleagues are also those which have been noted (see above) to exist between overloaded and non-overloaded individuals; this is what one could expect if individuals of the two types were differentially exposed to overload. For instance, in several investigations (Friedman et al., 1960; Friedman et al., 1964; Rosenman & Friedman, 1963) small groups of subjects who "completely manifested" the two behavior types have been compared in biochemical and physiological factors. Although the number of subjects employed in these studies was small, in each case significant differences in serum cholesterol appeared between subjects of the two types, with the Type A subjects showing higher cholesterol levels. In all cases, there were no differences in dietary habits which could account for the physiological differences observed between the two groups. Therefore, it is possible that the

differential tendencies of Type A and Type B individuals to select themselves into overloading positions may be of primary importance in the etiology of the physiological differences which were observed.

Corroborative evidence on these points is presented in an investigation performed by Sloan et al. (1962). In this study, thirty-three students were placed on a fat-free diet for eight days, after which time their levels of serum cholesterol were determined. At a later date, the subjects were administered an unstructured psychological interview. Following the interview, the interviewer made an intuitive rating of each subject on a variety of traits; the rater was unaware of the subjects' serum cholesterol levels at the time of the rating. There is no question that the ratings employed by Sloan et al. were highly subjective and impressionistic. Nevertheless, the findings closely resemble those reported in the studies described above. In particular, Sloan et al. report correlations of .53 between serum cholesterol and the subjects' "need for social achievement," .49 between serum cholesterol and the subjects' "ambition," and .63 between serum cholesterol and the subjects' "autonomy." As argued above, it seems likely that ambition, autonomy, and need for social achievement (traits which seem to resemble the Type A syndrome) in a person may lead him to seek out positions in which he will be exposed to role overload. To the extent that this occurs, and

insofar as exposure to role overload does in fact lead to increases in serum cholesterol, then some of the common variance between serum cholesterol and the personality variables studied appears to be explained. These data, in spite of the casual methodology employed, appear to be a strong corroboration of the findings presented above.

Other interesting data come from an investigation performed by Payne et al. (1963). In this study, the authors determined the serum cholesterol of a large number of students. At an unspecified time following this determination, those students who were still in school were asked to volunteer for a lengthy psychological testing session.

As part of the testing period, Payne et al. administered to their subjects the "Nufferno Level Test," a power test of intelligence. All subjects were informed that the test was an IQ test; however, none of them was aware that the length of time which they spent working on the test was being recorded. No relationship was found between IQ and serum cholesterol; however, it was found that persistence on the test involved correlated .76 ($p < .001$) with cholesterol. To the extent that persistence on the IQ test used can be seen as one manifestation of the subjects' general propensities to involve themselves in achievement tasks (see Atkinson and Feather, 1965), these findings appear to be consistent with other data presented here.

It should be expected that groups of subjects who are high in the personality traits under consideration would also experience a higher than normal rate of coronary heart disease. Data supportive of this prediction have been presented in a number of retrospective investigations (in which survivors of an episode of coronary disease are compared with a control group, the latter presumably free of coronary disease). For instance, Russek (1965) has noted that:

In almost every instance we found the young coronary patient to be a victim of overwork, often as a result of an unrelenting drive, intense desire for recognition, or a profound sense of obligation to his employer, his family, or others.

(Russek, 1965, p. 505; emphasis added).

And elsewhere (Russek and Zohman, 1958) he has written that:

Almost without exception the young coronary patient was found to be an aggressive, ambitious individual who had lived beyond his normal capacity and tempo.

(Russek & Zohman, 1958, p. 274)

Other similar data (or clinical impressions) are reported by Friedman and Rosenman (1960); Cleveland and Johnson (1962); Keith et al. (1965); and Dunbar (1948).

In retrospective investigations of this sort, it is possible that the patients' knowledge of their diseased status may significantly influence the responses which they give during the testing session. However, at least one retrospective study has been reported in which this problem does not exist. In this

investigation (Jenkins, 1965), twenty-five "silent" infarction patients were isolated from a large group of participants in a prospective investigation of coronary heart disease. All of these subjects had a myocardial infarction, as documented by EKG data; however, none of them was aware of this condition. None of the subjects had experienced any physical symptoms as a result of his heart attack, and none of them had been informed of its occurrence. Thus, any differences found between these subjects and individuals free from coronary heart disease cannot be attributed to the subjects' knowledge of their diseased condition.

For a control group, Jenkins selected twenty-five other participants from the original study population. These control subjects were matched with the silent infarct patients on age and occupation. It was found that the infarct group differed from the controls in being higher in reported "present drive," "sense of time urgency," and "history of past social achievements." These data, of course, are highly supportive of the argument made above.

Furthermore, supportive data have been presented in one major "prospective" study of coronary heart disease. In this investigation (Rosenman et al., 1966), extensive health and personality measurements were taken on 3,182 male subjects. Four years later, these subjects were studied for evidence of newly-occurring heart disease. The subjects who exhibited such evidence were then compared with those subjects who had remained free of coronary disease. It was found that men who exhibited the "Type A" behavior pattern were

far more likely to have experienced new coronary disease during the follow-up period than were men who exhibited the "Type B" pattern. Indeed, in relatively young subjects (ages up to forty-nine), this personality syndrome was the best predictor of coronary heart disease employed in the study. Rosenman et al. conclude that:

The present results clearly indicate that the presence or absence of a particular overt behavior pattern carries a profoundly important prognostic relevance.

(Rosenman et al., 1966, p. 91).

A Laboratory Investigation

In order to gain further knowledge about these issues, a laboratory study was performed which involved the simulation of role overload and role underload as they might appear in ongoing organizations. The purposes of this experiment were two-fold. In the first place, we were interested in seeing if the phenomena noted above could be elicited, using the same generic stressor (role overload) employed in the previously-cited studies, in a brief experimental session. In the second place, we were intrigued by the possibility that these effects might be mediated by the personalities or abilities of the subjects involved, in the sense that individuals with different personalities might react differently to the same objective conditions.

Methods

Sample.--Subjects were seventy-three male underclassmen at the University of Michigan. All subjects were paid volunteers for this experiment.

Experimental Procedure. -- The subject was greeted by the experimenter and was immediately taken to the experimental room (a cubicle equipped with a chair, a table, and a one-way mirror). Once the subject was seated, the experimenter left the room and a technician entered to draw a small (approximately 25 cc.) blood sample. The subject was then left alone for approximately one minute.

Following this brief rest, the experimenter re-entered the subject's cubicle and read the instructions. The subject was told that, at the start of the work period, he would be given a number of anagrams and that he should attempt to solve as many as he could. It was explained that, at the end of five minutes, the experimenter would return and remove all of the first group of anagrams and give the subject a new set. The subject was told that this procedure would continue for one hour and that his score would be the total number of anagrams which he correctly decoded during the work period. Finally, the subject was told that the anagrams would be sent "at a standard rate, which has been designed to be appropriate for college-ability students," and he was given a number of communications intended to arouse his achievement motivation.

The experimenter then handed the subject a stack of anagrams and retired to another room. All subjects in the objective overload condition received twelve anagrams in this set; all subjects in the objective underload condition received seven anagrams in this set.

The experimenter returned to subject's cubicle every five minutes, gave the subject a new set of anagrams, and removed all of the old anagrams. The rate at which the new anagrams were given, although described to the subject as standard, in fact was determined by (a) the subject's condition and (b) the subject's level of performance. In the overload condition, the subject was given approximately 35% more anagrams than he could decode in each five-minute period; in the underload condition, the subject was kept waiting approximately 30% of the time. Thirty-seven subjects were run in the overload condition, and thirty-six subjects were run in the underload condition.

After one hour, the subject was interrupted by the experimenter, and the technician drew a second blood sample. Following the taking of this sample (and a rest of approximately one minute), the subject was asked to fill out a brief post-experimental questionnaire. The subject was then paid for his cooperation, and any questions which he had about the experiment were answered.

Biological measures. -- The blood samples taken at the beginning and end of the experimental session were analyzed for cholesterol in a Technicon "auto-analyzer." The method employed was a modification of the procedure described by Levine and Zak (1964); the double-determination reproducibility of the measure is 4 mg./100 ml. in the laboratory used.

Personality measures. -- A variety of personality data were obtained on the subjects in the laboratory study. Each of the

subjects responded to a self-report questionnaire designed to measure various facets of the Type A personality syndrome; the several parts of this measure had previously been shown (Sales, 1969) to correlate highly with an overall measure of this syndrome (the "Jenkins Activity Survey"). In addition, data on three standard psychological variables were obtained; these are verbal ability, need for achievement, and need for power. The data on verbal ability were obtained from the subjects' performance on the verbal section of the Scholastic Aptitude Test, taken when the subjects were high school seniors. Data on nAchievement and nPower were derived from six TAT protocols scored in the standard manner (Atkinson, 1958). Verbal ability was chosen for study because it was felt that the subjects' ability might mediate their reactions to the verbal experimental task; nAchievement and nPower were selected because these motives seemed to incorporate parts of the Type A syndrome and because it was felt that thematic methodology might yield data not obtainable in a self-report questionnaire.

Self-report dependent measures. -- Among the data available from the post-experimental questionnaire were measures of (a) the subjects' subjective work load and (b) their enjoyment of the task (essentially a measure of job satisfaction).

Statistical methods. -- Two-way analyses of variance, employing objective work load (experimental condition) and subjective work load as the variates, were used. In the case of analyses involving serum cholesterol, the analysis was performed on the subjects'

post-experimental cholesterol values, with the data corrected for the subjects' initial levels through a covariance procedure.

Findings

Overall, there was no significant effect of variations in work load (either objective or subjective) upon serum cholesterol. Subjects in the objective overload condition exhibited a mean increase in cholesterol of 4.74 mg./100 ml. during the experimental hour, while subjects in the objective underload condition exhibited virtually no changes whatever in cholesterol. To be sure, the obtained data are in the expected direction (i.e., with overloaded subjects showing stronger increases in cholesterol than are shown by underloaded subjects); however, the F ratio is a non-significant 2.11 ($p < .20$, 1 and 69 dfs). Furthermore, there was no consistent tendency of subjects who were Type A (as measured by either the self-report inventory or the TAT procedures) to respond to the experimental conditions with changes in serum cholesterol which differed from those exhibited by the Type B subjects.

However, a significant interaction effect did appear between objective work load and subjective work load with changes in serum cholesterol as the dependent variable. This effect is shown in Table I.

Insert Table I about here

As can be seen, subjects who were objectively overloaded and who felt overloaded showed increases in cholesterol, as did subjects

who were objectively underloaded and who felt underloaded. However, subjects who were overloaded but felt underloaded showed decreases in cholesterol, and so did subjects who were underloaded but felt overloaded. The changes involved may appear small; however, they represent variations of five to ten percent from the subjects' mean initial cholesterol levels. Considering the brief time period used and the relatively peripheral nature of the task (compared, say, to tasks used in ongoing organizational settings), the effect is quite striking.

However, this is a perplexing effect, and the relationship between it and the findings reviewed above is not immediately apparent. Nevertheless, data available in the present study allow an interpretation of this effect which, if somewhat speculative, is nevertheless reasonably convincing and fully congruent with previous research.

The problem in interpreting this result is that "subjective work load" (measured by the item, "How much work do you feel you had to do during the work period?") remains an ambiguous entity. It is clear that, to some degree, an individual's subjective work load is caused by the objective work load to which he is exposed. However, in the present study the relationship between the two forms of workload was not particularly high; the point-biserial correlation between experimental condition and subjective work load was found to be only $+0.36$. This leaves eighty-seven percent of the variance in the subjective work load measure to be

explained by other factors.

The preference of the author is to interpret an individual's subjective work load as caused, in part, by his verbal ability. It is thus assumed that individuals who have low verbal abilities should report relatively high subjective work loads in both conditions of the experiment and that individuals who have high verbal abilities should report relatively low subjective work loads in both conditions of the experiment.

Several bits of data support this interpretation. In the first place, a significant correlation ($r = -.36$) was observed between the subjects' scores on the verbal portion of the SAT and their reported subjective work loads. This correlation obtained in both conditions of the present experiment. Furthermore, the job satisfaction data (obtained from the post-experimental questionnaire) were as one might expect if "subjective work load" reflected in large part the subjects' verbal abilities. That is, subjects who have low verbal ability (i.e., subjects who report high subjective work loads) disliked objective overload, presumably because it represents the sort of challenging task at which they typically fail; however, these subjects reacted positively to objective underload, since here they found themselves succeeding at the kind of task in which they usually fail. Subjects who have high verbal ability (i.e., subjects who report low subjective work loads) liked objective overload, since this is the kind of task at which they excel; however, these subjects reacted negatively

to objective underload, presumably since they found such an easy task to be boring. Data relevant to this effect are presented in Table II.

 Insert Table II about here

In addition, it is of some interest to note that the statistical removal of verbal ability (via a covariance technique) from the relationships presented in Tables I and II reduced both of the interaction F ratios reported above to small and statistically non-significant figures. This is what one would expect if "subjective work load" measured primarily the subjects' verbal ability.

Discussion

The cholesterol finding from this investigation is quite consistent with the notion that organizational stress can cause substantial increases in the serum cholesterol of stressed individuals. In the present study we found significant increases in the serum cholesterol of overloaded individuals whose verbal abilities did not "fit" them for the demands made on them. Similarly, and somewhat unexpectedly, we found significant increases in the serum cholesterol of underloaded individuals whose verbal abilities did not fit them to their environments. Equally important, we found decreases in the serum cholesterol of subjects who seemed well fitted to their "organizational" environments. That the job satisfaction data parallel the

cholesterol findings is supportive evidence for the contention that a lack of "fit" between the person and the environment can cause serious strain in the persons involved.

There are, in fact, some clinical impressions in the medical literature which support the contention that people who are not fitted to their jobs are at particular risk of death due to coronary disease. Wolf (e.g., 1961) and Cathey et al. (1962) have argued that employed men who work "without joy," like Sisyphus, are those who are most prone to coronary disease. If one assumes that subjects who work without joy are those who are poorly fitted to their environments -- an assumption supported by the job satisfaction data presented in Table II -- then this contention is directly parallel to the findings reported here. It should be mentioned that the medical citations draw upon clinical judgment rather than "hard" data, and that the conclusion stated in these articles is somewhat at odds with the statement frequently made by Friedman, Rosenman, and their collaborators that the Type A individual "thrives on stress." Nevertheless, the parallelism between Wolf's contention and the data reported here make his interpretation at present highly attractive.

In addition, a recent publication by Hinkle et al. (1968) presents data which can be interpreted as highly supportive of the argument made here. In this article Hinkle and his collaborators demonstrate that, in the population studied, risk of death due to coronary disease was a joint function of (a) the subjects'

educational level and (b) the subjects' organizational position. Subjects without college educations in executive or managerial positions had particularly high rates of coronary disease (compared to subjects with similar educations in non-managerial positions). Similarly, subjects with college educations in non-managerial positions had particularly high rates of coronary disease (compared to subjects with similar educations in managerial positions). If one assumes that college-educated individuals are more "fit" to managerial positions and that non-college-educated individuals are more "fit" to non-managerial positions, then this finding can be seen as directly parallel to the data presented in Table I. It should be mentioned that Hinkle et al. do not interpret their data in this way; nevertheless, the parallel between their findings and the argument presented here appears quite striking.

Our conclusions, from both the literature reviewed above and the laboratory investigation, are thus that organizational factors (in particular role overload) can contribute to the etiology of coronary disease, and that the deleterious effects of these factors are most strongly felt in individuals who are least "fit" to their organizational roles. This does not mean that organizational characteristics such as role overload are the only factors in coronary disease; furthermore, the relative influence of these factors (compared, say, to ingestion of high cholesterol foods) remains an open question. Nevertheless, it seems that organizational

stressors of the sort investigated here can no longer be ignored. Organizational administrators should thus understand that, if they overload their personnel (and particularly their less able personnel) in the hope of increasing productivity, they may thereby also endanger their employees' health.

But where do the findings cited above leave the "Type A" personality syndrome, about which so much has been written in the medical journals? In the opinion of the author, the net result of these data is to draw into question the assumption that the Type A syndrome is in itself a direct cause of coronary disease. Rather, it seems that the Type A syndrome (or the presence of one or more of its constituent traits) causes the individual to select himself into positions -- and particularly overloading positions -- for which his abilities do not fit him. The Type A person has been described by Friedman and his colleagues as an individual who is driven constantly to seek out new challenges and responsibilities. The net outcome of this tendency, it would appear, is that the Type A person sooner or later should take onto himself more work, more organizational responsibility, and more duties than he can comfortably handle. When this happens, the individual under investigation will experience overload for which he is not fit, and this should lead to increases in his serum cholesterol.

A further implication of these data is that other investigations by behavioral scientists on the etiology of coronary disease would be highly fruitful. Whether or not the Type A person does

take onto himself duties for which he is not "fit," for instance, remains an open question. Similarly, it is currently uncertain whether or not organizational stressors other than role overload would have equally pronounced effects upon the health of the stressed individuals. Furthermore, it remains unknown whether overloaded individuals who "strive with joy" will in fact experience lower rates of coronary disease than will overloaded individuals who strive without joy (e.g., Wolf, 1961), although it should be noted in passing that preliminary evidence (Brooks and Mueller, 1966) supports this hypothesis. Finally, the personality dimensions other than the Type A syndrome which might lead individuals into overloading positions -- and the relationships between these dimensions and rates of coronary heart disease -- are as yet unknown. All of these questions suggest exciting and valuable research possibilities, and they surely do not exhaust the remaining issues.

FOOTNOTES

1. The author is indebted to John R. P. French, Jr. for his assistance and encouragement. Preparation of this article was facilitated by grants from the National Aeronautics and Space Administration (#NGR-23-005-135) and the Michigan Heart Association.

2. If each of the obligations involved required the individual to do something which is beyond his ability, such that he could never meet his obligations even given an infinite amount of time, the situation would be one of "qualitative role overload." We shall not deal with this phenomenon here, since it has received no attention in the medical literature.

3. This point could be made of all field studies of role overload, although it does not necessarily deny the value of such studies.

4. The topic of personality correlates of coronary disease is one of the more hotly contested issues in the medical literature, and all of the considerations involved in this area are not yet clear. Nevertheless, the data cited here appear to be relatively consistent, and to the knowledge of the author there are no findings which strongly challenge the conclusions drawn here.

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Table I. -- Changes in Serum Cholesterol as a Function of
Objective Work Load and Subjective Work Load^a

Level of Objective Work Load	Level of Subjective Work Load	
	High	Low
Overload	+7.42 (28)	-13.42 (9)
Underload	-3.00 (14)	+ 9.09 (22)

^aF(interaction) = 5.87, $p < .05$. Data are in mg./100 ml;

Cell N's are given in parentheses.

Table II. -- Enjoyment of the Task as a Function of Objective
Work Load and Subjective Work Load^b

Level of Objective Work Load	Level of Subjective Work Load	
	High	Low
Overload	3.81 (28)	4.43 (9)
Underload	4.09 (14)	3.78 (22)

^bF(interaction) = 5.11, $p < .05$. Cell N's are given in parentheses.